# An atlas of CO2 storage potential in the nearshore waters of the Texas coast – American Recovery and Reinvestment Act – "Gulf of Mexico Miocene CO2 site characterization mega-transect"

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# An Atlas of $CO_2$ Storage Potential in the Nearshore Waters of the Texas Coast American Recovery and Reinvestment Act—"Gulf of Mexico Miocene $CO_2$ Site Characterization Mega-Transect" Study


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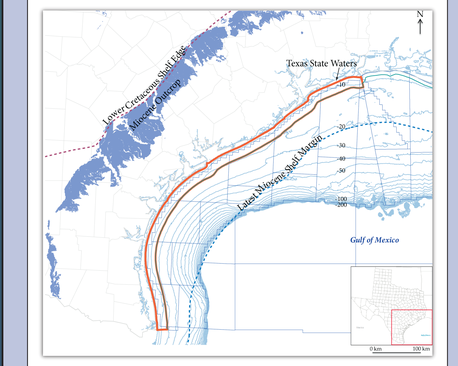
## Introduction

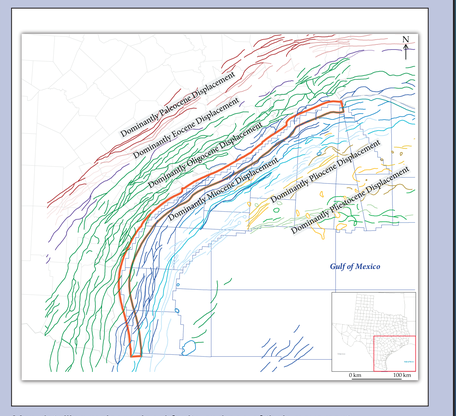
Geosequestration of anthropogenic carbon in offshore sites offers several advantages over onshore geosequestration, including (1) lack of USDW and (2) the existence of a single surface and subsurface (pore space) owner (e.g., state or federal government) that can accept long-term liability for the $CO_2$. The offshore state waters of Texas represent a significant state and national geosequestration resource that has high potential for near-term development. Data availability from decades of extensive petroleum exploration (e.g., well and seismic data) and infrastructure (e.g., pipelines) are advantageous. The populous Houston metro area and its high concentration of industries could provide nearby sources of anthropogenic $CO_2$. The Miocene-age geologic section is especially prospective because of its numerous potential sandstone reservoirs. In addition, the Miocene section encompasses multiple thick, regionally extensive mudrock units that could compose high-quality confining systems. In order to quantify the prospectivity of the Miocene section along the upper Texas coast, the Gulf of Mexico Miocene Site-Characterization Mega-Transect study is compiling a geologic atlas that can serve as a resource for commercial, regulatory, and other stakeholder interests in the area. The atlas will summarize our research on several important topics: (1) a summary of the utilized datasets; (2) an overview of the regional geology, including the petroleum system as analog for injected $CO_2$; (3) a synopsis of the confining system, including both top-seal and fault-seal research; (4) a review of regional capacity estimates; and (5) a summary of $CO_2$ "plays" and specific prospective storage sites. Presented here are examples of regional geologic features and research components utilized to estimate regional $CO_2$ storage capacity.

## Regional Features

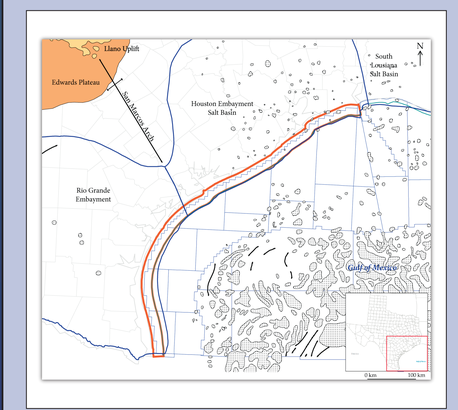
Four maps of the northwest Gulf of Mexico Basin compiled from various sources; see references.
Note study area (solid red polygon), offshore portion of Texas State Waters, approximately 1 km (10 mi) wide.



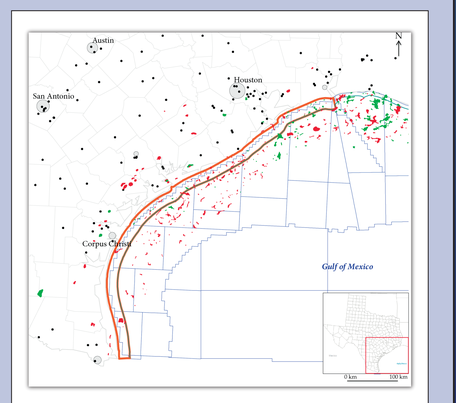

Map highlighting Lower Cretaceous shelf edge (dashed maroon line), outcrop of Miocene-age rock units, upper Miocene shelf margin (dashed blue line), modern-day bathymetry (solid blue lines), and study area (solid red line).




Map detailing major regional faults and age of their movement. Note basinward decrease in age of fault movement and Miocene-age fault displacement dominating study area.




Map showing salt bodies (stippled polygons) and selected physiographic features (e.g., Rio Grande Embayment, Houston Embayment Salt Basin, and South Louisiana Salt Basin). Study area outlined by red polygon.




Map highlighting oil (green) and gas (red) fields and $CO_2$ point sources (black dots) in and around study area (red polygon), the offshore portion of Texas State Waters, approximately 16 km (10 mi) wide.

## $CO_2$ Regional Static Storage-Capacity Calculations

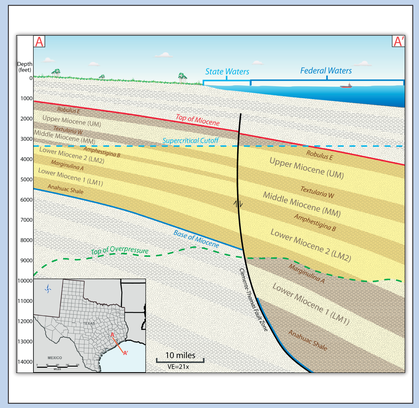
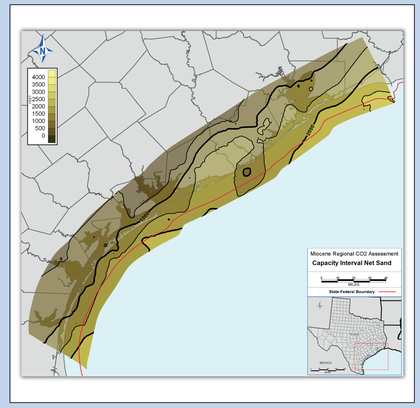
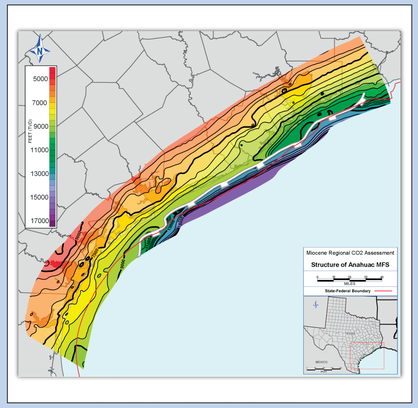


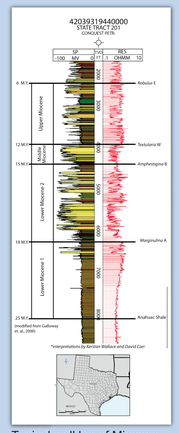

Diagram illustrating composition of interval over which static capacity was calculated. Capacity interval defined here as portion of Miocene strata present at depths suitable for $CO_2$ storage. Top of capacity interval equivalent to shallowest depth at which $CO_2$ will remain supercritical or the top of the Miocene interval, whichever is deeper. In study area, minimum depth for supercritical $CO_2$ is 3,300 ft (1,006 m). Base of capacity interval is top of overpressure or the base of the Miocene section, whichever is shallower.



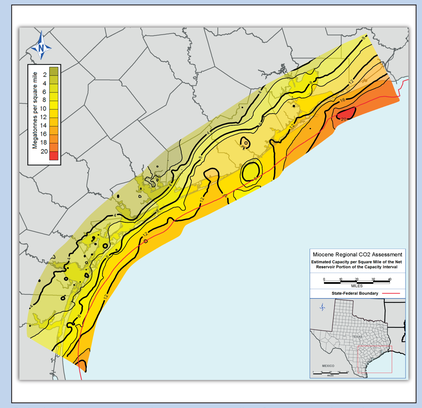

Regional map of net sand thickness of Texas coast in capacity interval based on measurements from 1,009 well log raster (SP) curves.




Structure map of top of Anahuac Formation (base Miocene coarse clastics). Grid and map generated from 3,042 well log picks.




Typical well log of Miocene interval along upper Texas coast. Note unit tops used in regional correlations (e.g., middle Miocene), paleontological markers (italics, right), and geologic age (left). Also note approximate location of well (inset map).




Calculated storage capacity per square mile of net reservoir portion of capacity interval.

**The methodology (below) used to generate static-capacity-related maps and figures is based on Goodman et al. (2011).**

$G_{CO2} = At \times hg \times \Phi t \times \rho_{CO2} \times E_{saline}$ (tonnes or metric tons),

**where**

**At** = geographical area defining region of $CO_2$ storage
**hg** = gross formation thickness (Note: we further refined this term by using the net sand map, above.)
**Φt** = total porosity
$\rho_{CO2}$ = density of $CO_2$ estimated at temperature and pressure anticipated storage (reservoir) conditions
$E_{saline}$ = $CO_2$ storage-efficiency factor

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